DOCUMENT RESUME

ED 203 412 CS 503 413

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TITLE Judging the Accuracy of Facial Expressions: A Methodological Inquiry.
PUB DATE Apr 80
NOTE 17p.; Paper presented at the Annual Meeting of the Eastern Communication Association (Ocean City, MD, April 24-26, 1980).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS College Students; *Communication (Thought Transfer); *Communication Research; *Cross Cultural Studies; *Nonverbal Communication; Nonverbal Tests; *Research Methodology
IDENTIFIERS *Facial Expressions

ABSTRACT

The extent to which human facial expressions are universal and cross-culturally recognizable has been the subject of considerable debate. Two approaches have been used in studies of facial expressions: the judgment approach entails showing examples of facial expressions to various cultures or groups of people and determining whether they interpret a facial expression as signifying the same or a different emotion; the components approach studies whether the actual components of facial expressions shown in two or more cultures are the same or different. Two studies were conducted to determine if accuracy in decoding facial expressions was a function of the number of possible choices provided to the receiver. It was hypothesized that the number of alternative choices of emotions provided to receivers was inversely related to the accuracy of identifying facial expressions. One hundred eighty-five undergraduate college students were presented with still black-and-white photographs displaying various facial expressions and asked to score them according to five forms that differed in the number of alternative emotions presented to the subjects. Results from both studies supported the hypothesis and suggested that facial expressions are not inherently identifiable but are a function of the choices available to receivers. (HOD)

JUDGING THE ACCURACY OF FACIAL EXPRESSIONS: A METHODOLOGICAL INQUIRY

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Paper selected as a "Top Three Paper" for presentation to the Nonverbal Communication Interest Group, at the annual meeting of the Eastern Communication Association, Ocean City, Maryland, April, 1980.

JUDGING THE ACCURACY OF FACIAL EXPRESSIONS:

A METHODOLOGICAL INQUIRY

The extent to which human facial expressions are universal and cross-culturally recognizable has been the subject of considerable debate. Charles Darwin (1965) in the last century observed that persons who felt particular emotions tended to express them in a similar manner regardless of culture. For many years Darwin's ideas failed to gain much acceptance. Klineberg (1940) and Birdwhistle (1970) maintained that facial expressions, like words, were culturally specific and had little meaning between cultural groups. Unfortunately, Birdwhistle based his assumptions about facial expressions on a linguistic model that is inappropriate for the study of nonverbal communication (Andersen, Garrison, & Andersen, 1980; Dittman, 1978; Siegman & Feldstein, 1978). Recent research has demonstrated that nonverbal communication is quite different from verbal communication, although the two usually co-occur. Siegman and Feldstein (1978) maintain that both phylogenetically and ontologically, nonverbal communication occurred prior to verbal communication and has a number of distinctly different qualities. Similarly, recent research has provided considerable evidence that facial expressions, unlike words and language, are cross-cultural and universal.

In a series of excellent studies, Paul Ekman and his associates have established the existence of cross-cultural, universal facial expressions (Ekman, 1972, 1973; Ekman & Friesen, 1975; Ekman, Sorenson, & Friesen, 1969). In Ekman's (1973) summary of this research he discusses previous studies which have employed the "judgment" approach. This approach entails showing examples of facial expressions to various cultures or groups of people and determining whether they interpret a facial expression as signifying the same or a different emotion. Ekman (1973) supports the judgment approach as the best way to avoid the numerous pitfalls of the "components" approach, which studies whether the actual components of facial expressions shown in two or more cultures are the same or different.

However, the judgment approach, according to Ekman (1973), has several problems that researchers need to resolve. First, what should the observers of facial expressions be asked to say? Should they be allowed to select any word to describe an emotion, or should they be given a list? If they are allowed to select any word, do synonyms count as correct answers? Ekman (1973) maintains that in all of the experiments which have employed the judgment approach, a common solution to these problems has been employed. In each case, observers have been given some set or list of emotional words to use in describing facial expressions.

While providing observers with a list or set of words that narrows their choices has some obvious advantages for researchers, this is obviously not how individuals operate in real human communication situations. In reality, observers of facial expressions have an almost limitless set of choices as to which expression they are viewing. Of course, other cues may have the effect of narrowing the possible options. Knowledge of

the source's mood, other nonverbal behaviors such as tone of voice, gestures, body movements, etc., and the context, as well as any accompanying verbal information, may narrow the possible choices and aid the observer in correctly identifying the source's facial expressions. Observers must also process these other cues themselves to properly evaluate the facial expression's meaning. In the judgmental experiments conducted by Ekman and others, receivers are given lists of facial expressions which artificially narrow the range of potential choices. The purpose of the two studies contained in this report is to determine if accuracy in decoding facial expressions is a function of the number of possible choices provided to the receiver. It is suspected that providing a narrow set of choices to an observer has much the same effect as other communication cues or contexts. They act to narrow the choices, reduce ambiguity, and improve the accuracy of recognizing facial expressions.

Thus the hypothesis is:

> H: The number of alternative choices of emotions provided to receivers is inversely related to the accuracy of identifying facial expressions.

If this hypothesis is confirmed, it provides evidence that facial expressions are not completely meaningful by themselves but are more accurately identified when the receiver's choices are narrowed. If this hypothesis is not confirmed, then it is likely that facial expressions contain such a high degree of identifiable meaning that they are inherently recognizable regardless of other choice-narrowing cues, such as context, mood, relationship, or verbal information. Failure to confirm this hypothesis would support the concept of universal facial expressions with inherent meaning.

The next question is, what happens if the receivers are asked to identify facial expressions for which no alternative choices are provided? In this case, subjects can be asked to write a word representing the facial expression that they are viewing. In this situation, appropriate synonyms for each facial expression must be accepted as correct identifications.

Thus an additonal research question is posed:

> Q: When lists of alternative emotions are provided to receivers, as opposed to purely open-ended responses, does receiver accuracy in identifying facial expressions increase or decrease?

If providing lists of alternative emotions improves the accuracy of identifying facial expressions, then these expressions are not inherently identifiable. This would mean that other relational or contextual cues provide additional information that leads to more correct identifications. If lists of alternative emotions cause a decline in receiver accuracy in identifying facial expressions, then contextual or relational

cues are distractors which cause subjects to confuse otherwise recognizable facial expressions.

STUDY 1

Methods

Subjects

One hundred eight female and 77 male undergraduate students attending a large eastern university participated in the study. The subjects had a mean age of 20.5 years (range, 18-55 years) and were enrolled in an introductory nonverbal communication course in the spring semester, 1979. subjects had a mean age of 20.5 years (range, 18-55 years) and were enrolled in an introductory nonverbal communication course in the spring semester, 1979. Facial expressions had not yet been discussed in the course. All subjects participated voluntarily, although for their participation they did receive two bonus points out of a possible 500 points in the course.

Measure

Still black-and-white photographs of facial expressions developed by Ekman and Friesen (1975) were chosen to comprise the instrument. The stimulus photographs portrayed five male and four female actors displaying six facial expressions which had been validated by Ekman and Friesen (1975) as portraying a particular emotion that was widely recognized both within American culture and in other cultures as well. In addition, four blends of these emotions were included. The photographs by Ekman and Friesen (1975) showed happiness (photos 31, 36), sadness (photos 38, 43), surprise (photos 1, 3) anger (photos 24, 27), fear (photos 10, 12), disgust (photos 16, 18), anger-disgust blend (photo 50), happiness-surprise blend (photo 45), happiness-contempt blend (photo 49), and a fear-surprise blend (photo 47). Two photographs of each pure emotion and one photograph of each blend were combined to form a set of 16 stumulus expressions. The photographs were transferred to 35 mm slides to facilitate the administration of the measure to a large experimental group. The slides were produced by a professional publication photographer.

A scoring sheet was constructed which contained a list of the six pure emotions and four blended emotions depicted in the video measure. Sixteen spaces were provided where the subjects could indicate the emotion they thought was communicated by each facial expression. A group of Likert-scale personality tests and demographic questions preceded the list of emotions; however, for the purpose of this study the results from the personality tests were not included in the analysis.

Procedure

Each subject was provided with a scoring sheet, and the experimenter explained that the test was designed to see how well people could determine emotional states via facial expressions. The subjects were in-

structed to view each slide and then indicate the emotion, from the list of 10 alternatives, which they felt best described the facial expression exhibited by the stimulus face.

The 16 slides were then presented in random order to the subjects. Each slide was presented for five seconds. The subjects were given an additional five seconds in which to mark their choice before the next slide was presented. There was no interaction between the experimentor and the subjects during the viewing of the slides.

Variables

The independent variable for this study was the number of possible alternative emotions presented to the subject. The analysis employed data from two different studies. The first study by Ekman and Friesen reported in Unmasking the Face (Ekman & Friesen, 1975) presented the subjects with six choices of emotions. In the present study, the subjects were given 10 alternative emotions from which to choose their answer. In both cases six different emotions were portrayed by the stimulus face--anger, disgust, happiness, sadness, fear, and surprise. The four facial blends were not included in these analyses.

The dependent variable in the analyses was the percentage of correctly identified facial expressions.

Statistical Analyses

The Pearson product-moment correlation analysis was applied to the data. The significance level was set at the p .05 level.

Results

Tentative support for the hypothesis was obtained. Table 1 presents the accuracy scores in percentages in relation to the number of possible alternative emotions presented to the subjects. It is evident that the accuracy of identifying facial expressions is greater for Ekman and Friesen's study, where six alternative choices of emotions were provided, than for the present study, where 10 alternative choices of emotions were presented. This difference was least evident between sadness expressions and most evident for fear expressions (Table 2).

The Pearson product-moment correlation analysis yielded an $r = .588$ ($p < .05$). Further, the variance in accuracy attributable to the number of alternative choices of emotions was 34.6%. Hence the analysis indicates that over one-third (34.6%) of the difference between the two data sets is accounted for by the number of alternative emotions presented to the subjects in each study.

This result raised the question of what effect the number of alternative emotions presented to a subject might have. Alternative explanations for these results are possible. Ekman's procedures may have been different than those employed in the present study. Or Ekman's subjects

may have been more sensitive receivers of nonverbal cues. In order to obtain a better test of the hypothesis, Study 2 was initiated. Study 2 was a purely experimental design, conducted to eliminate plausible alternative explanations for the data in Study 1.

STUDY 2

Methods

Subjects

One hundred two female and 94 male undergraduate students enrolled in a large eastern university were selected for this study. The subjects, with a mean age of 20 years (range, 17-27 years), were enrolled in an introductory nonverbal communication course in the fall semester, 1979; however, facial expressions had not previously been discussed. The subjects all participated voluntarily.

Measure

The same measure, containing black-and-white slides of facial expressions, used in Study 1 was employed in this study. The only alteration was the removal of the four slides depicting blends of emotions.

Five forms of the scoring sheet were constructed. All of the personality test items in Study 1 were deleted; however, the demographic questions were retained. Also, all forms contained spaces where the subjects could indicate their choices. The five forms differed in the number of alternative emotions presented to the subjects. One form listed the six pure emotions-- happiness, sadness, anger, fear, disgust, and surprise; one form listed those six pure emotions plus happiness-surprise and anger-disgust blends; one form listed those eight alternatives plus happiness-contempt and fear- surprise blends; one form listed those 10 alternatives plus sadness-disgust and sadness-fear; and one form listed no alternative emotions. This last scoring sheet, which contained no list of emotions, instructed the subjects to write a word they felt best described the emotion depicted. Any word which was a direct synonym was scored correct. Any other word was scored as incorrect. A Roget's (1976) thesaurus was employed as an aid, but other obvious synonyms were accepted as correct. A list of acceptable synonyms is provided in Table 3.

Procedure

The scoring sheets were distributed in random order to the subjects. The presentation directions and procedures were identical to those in Study 1. No oral examples of possible word choices were provided to the subjects who had the scoring sheet form without a list of alternative emotions. The subjects were further instructed not to interact in any way with the other subjects during the experiment.

Variables

The independent variable was the number of emotions provided for the subjects while identifying the facial expressions. The subjects had 6, 8, 10, or 12 choices, or an open-ended form without any list of alternative emotions.

The dependent variable was their number of correctly identified facial expressions (also provided in percentages in Table 4). Split-half reliability, using the Spearmanrown prophecy formula (Wood, 1960) was only .49, indicating marginal reliability.

Statistical Analyses

In order to test the hypothesis more fully than in Study 1, a four-treatment purely experimental design was employed. Means for these four treatments (6, 8, 10, and 12 alternative choices of emotions) were submitted to a one-way analysis of variance. To explore differences among individual cell means, a series of six Newman-Kuels tests was utilized (Winer, 1971). Additionally, a linear trends analysis (Kirk, 1968) was computed to ascertain the linearity of relationship between the number of alternative choices of emotions provided to the receiver and their facial expression recognition scores.

To explore the research question, two types of analyses of variance were used. First, a one-way analysis of variance was used to detect differences among the five treatment means (open-ended and 6, 8, 10, and 12 alternative choices of emotions). This was followed up with 10 Newman-Kuels tests to explore all possible differences among these five treatment means. Second, a two-condition, one way analysis of variance was employed to test whether the open-ended question was significantly different from the combined 6,8, 10, and 12 alternative choices of emotions, which were collapsed into a single category.

All hypotheses were tested at the .05 alpha level. Power coefficients were computed a priori for the analysis of variance. For the four-treatment analysis of variance, power was computed to be .99 for large effects, .76 for medium effects, and .16 for small effects, indicating acceptable power levels for all but the small effects. For the five-treatment analysis of variance, power was computed to be in excess of .99 for large effects, .81 for medium effects, . and .17 for small effects, again indicating acceptable power for all except the small effect size. For the two-treatment analysis of variance, power was computed to be in excess of .99 for large effects, .89 for medium effects, and .24 for small effects, again indicating acceptable power for all except small effects.

Results

Results of Study 2 provided support for the hypothesis. The number of alternative choices of emotions provided to receivers is inversely related to the accuracy of identifying facial expressions ($F = 67.14$,

$p<.0001$, $eta^2 = 57$; see Table 5). Six Newman-Kuels tests (Winter, 1971) were computed to test for individual cell differences among the four treatment means. All six Newman-Kuels tests were significant ($p<.05$), indicating that all of the four treatment means (6, 8, 10, and 12 alternative choices of emotions provided to receivers) were significantly different from one another (see Table 6). Finally, a linear trends analysis was computed to ascertain the linearity of the relationship. This analysis revealed a significant linear component ($F = 181.47$; $p<.0001$) and a significant nonlinear component ($F = 9.97$, $p .001$), with 90% of the explained variance being linear and 10% of the explained variance being nonlinear (see Table 7).

Results of Study 2 provided an equivocal answer to the research question. A one-way analysis of variance, employed to detect differences among the five treatment means (open-ended and 6, 8, 10, and 12 alternative choices of emotions), was significant ($F = 50.9$, $p<.0001$, $eta^2 = 52$; see Table 8). Of 10 Newman-Kuels tests, computed to detect differences among the five treatment means, eight were significant and two were nonsignificant (see Table 9). Providing no alternative resulted in an accuracy score of 9.16, which was not significantly different from the accuracy score of 8.78 for eight alternative choices of emotions.

Finally, a two-condition, one-way analysis of variance was computed to test whether the open-ended question was significantly different from the combined 6, 8, 10, and 12 alternative choice of emotions, which were collapsed into a single category. This analysis revealed that the open-ended question produced higher accuracy scores ($x = 9.16$) than the combined closed-choice category ($x = 8.13$, $F = 7.0$, $p<.01$, $eta^2 = 04$; see Table 10).

DISCUSSION

Results of both Study 1 and 2 provided support for the hypothesis. When receivers are given more alternative choices of emotions, their accuracy of identifying facial expressions declines. In Study 1, which employed combined data from Ekman's (1973) research and from the present study, the number of alternative emotions provided to receivers accounted for 34.6% of the variance in accuracy of identifying facial expressions. Since plausible rival hypotheses could account for these differences in accuracy, Study 2 was conducted with a purely experimental design in which receivers were given the choice of 6, 8, 10, or 12 emotions. Thus Study 2 was a more internally valid test of the hypothesis. Study 2 was a provided even more support for the hypothesis. Differences in the number of alternative emotions provided to receivers accounted for 57% of the variance in receiver accuracy of identifying facial expressions.

The research question examined whether receiver accuracy in identifying facial expressions would be greater for open-ended questions than by providing receivers with choices of emotions to use in labeling the expressions. The open-ended question resulted in more accuracy than the 10- or 12-choice treatments. The open-ended question was not significantly different than the 8-choice treatment and resulted in less accuracy than the 6-choice treatment (see Table 9).

These results suggest that facial expressions are not inherently identifiable but are a function of the choices available to receivers. As the number of possible emotions increases, receiver accuracy--in identifying which emotion is conveyed by facial expression--decreases. Future research should examine the process by which receivers cognitively narrow their choices of emotions in facial expressions.

How did open-ended responses compare to providing the receivers with alternative choices? Interestingly, providing the receivers with six choices of emotions, as Ekman (1973) has done in a series of studies, resulted in greater accuracy than open-ended responses. Conversely, when receivers are given choices of 10 or 12 emotions, their accuracy in identifying facial expressions is inferior to that of the open-ended responses. These results suggest that receiver accuracy is improved if they are given few emotions to choose from. It also indicates that Ekman (1973) estimates of facial accuracy are slightly inflated. Providing receivers with a large number of emotions to choose from reduces their facial expression recognition accuracy and provides some confusion as to which facial expression has been portrayed.

These results both support and qualify the work of Ekman. The high recognition scores for the open-ended responses support the notion that facial expressions are recognized with a very high degree of accuracy (see Table 4). However, facial expressions are not identified in a vacuum. Other information provided receivers (in this case, the number of alternative emotions) can increase accuracy or decrease accuracy. This study indicates that over half of the variance in facial expression accuracy scores is a function of choice-narrowing or -widening cues.

Suggestions for Future Research

The present study has established that choice-narrowing cues have a large impact on facial expression accuracy score. This was done in an experimental setting by artificially expanding or narrowing the potential choices of emotions available to receivers. This study provides little evidence as to how receivers narrow the potential choices of emotions they see in facial expressions in real face-to-face communication. Future studies should examine the role of other variables which receivers employ to cognitively narrow their choices of the emotions they view in facial expressions. Researchers should explore the following variables, which may provide clues as to what emotion is being portrayed in facial expression: (a) verbal behaviors accompanying facial expressions; (b) vocal cues accompanying facial expressions; (c) kinesic or proxemic cues in the limbs and body which accompany facial expressions; (d) personal knowledge or familiarity with the source and her/his facial repertoire; (e) the previous emotional state of the source; (f) the context and environment in which the facial expression is displayed; and (g) the source's personality and communication traits. Separately or together, these cues may be crucial in how sources accurately identify facial expressions in real face-to-face communication.

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Table 1

Relationship between Number of Alternative Choices of Emotions and Accuracy Scores* in Study 1

Study	Emotion	Number of Choices	Percentage Correct
Ekman and Friesen	Anger	6	67%
	Sadness	6	84%
	Fear	6	85%
	Happiness	6	97%
	Surprise	6	95%
	Disgust	6	92%
Present study	Anger	10	50.3%
	Anger	10	51.9%
	Sadness	10	90.3%
	Sadness	10	66.5%
	Fear	10	16.2%
	Fear	10	56.2%
	Happiness	10	91.4%
	Happiness	10	68.6%
	Surprise	10	40.0%
	Surprise	10	71.9%
	Disgust	10	67.6%
	Disgust	10	40.0%

*Accuracy scores are represented as the percentage correct of accurately identifying facial expressions.

r .588

r^2 = .346

Table 2

Relationship between Type of Emotion and Difference between Accuracy Scores of Ekman (1973) and Study 1

Emotion	Change in Percentage Correct*
Anger	15.9%
Sadness	5.6%
Fear	48.8%
Happiness	17.0%
Surprise	39.0%
Disgust	38.2%

*These figures indicate the extent to which Ekman's subjects more accurately perceived the facial expressions than did the subjects in Study 1.

Table 3

Acceptable Synonyms
for Emotional Facial Expressions

HAPPINESS	SURPRISE
beaming	amazement
cheerful	astonished
delight	astonishment
delighted	disbelief
glad	shock
gladness	shocked
glee	stunned
happy	unbelievable
joy	unexpected
SADNESS	**DISGUST**
depressed	dislike
depression	displeasing
disappointed	displeasure
disappointment	distaste
distress	stinks
hurt	yuck
sad	
sorrow	
	FEAR
ANGER	afraid
	fright
aggravated	frightened
mad	scared
pissed	terrified
rage	

Table 4

Percentage Correct
by Type of Form and Emotion in Study 2

	Response Format				
Emotion	Open-Ended	6 Alternative	8 Alternative	10 Alternative	12 Alter
Anger	81.6%	84.6%	32.5%	51.3%	50.
Anger	89.5%	94.8%	57.5%	30.8%	42.
Sadness	76.3%	97.4%	100.0%	87.2%	70.
Sadness	76.3%	74.4%	60.0%	56.4%	30.
Fear	52.6%	71.8%	60.0%	18.0%	32.
Fear	65.8%	82.0%	92.5%	51.3%	42.
Happiness	100.0%	97.4%	80.0%	79.5%	80.
Happiness	94.7%	97.4%	92.5%	48.7%	50.
Surprise	76.3%	89.7%	90.0%	61.5%	50.
Surprise	94.7%	100.0%	72.5%	56.4%	62.
Disgust	47.4%	94.9%	82.5%	82.1%	75.
Disgust	57.9%	74.4%	57.5%	69.2%	40.
TEST TOTAL	76.3%	88.2%	72.9%	57.7%	52.
N	38	39	40	39	4(

Table 5

Analysis of Variance:
Effect of Number of Alternative Choices of Emotions
on Accuracy of Identifying Facial Expressions

Source	SS	df	MS	F	P	eta^2
Number of emotions provided	450.79	3	150.26	67.14	<.001	.57
Error	344.68	154	2.24			
TOTAL	795.37	157				

Table 6

Means for Accuracy of Identifying Facial Expressions
by Number of Alternative Emotions per Treatment

Treatment 1 6 choices	Treatment 2 8 choices	Treatment 3 10 choices	Treatment 4 12 choices
10.59*	8.78*	6.92*	6.25*

*All means were significantly different from one another as computed through Newman-Keuls test (alpha < .05)

Table 7

Linear Trends Analysis:
Test for the Linearity of the Hypothesis

Source of Variance	SS	df	MS	F	P
Linear component	406.12	1	406.12	181.47	<.0001
Nonlinear component	44.67	2	22.33	9.97	<.001
Error	344.68	154	2.24		
TOTAL	795.47	157			

Table 8

Analysis of Variance:
Effect of Number of Alternative Choices of Emotions
on Accuracy of Identifying Facial Expressions*

Source	SS	df	MS	F	P	eta²
Number of emotions provided	482.09	4	120.52	50.90	<.001	.52
Error	450.19	190	2.37			
TOTAL	932.29	194				

*This analysis is identical to Table 5 except that the open-ended questions were also analyzed.

Table 9

Means for Accuracy of Identifying Facial Expressions*
by Number of Alternative Emotions per Treatment

Treatment 1 6 choices	Treatment 2 no choices	Treatment 3 8 choices	Treatment 4 10 choices	Treatment 5 12 choices
10.59	9.16	8.78	6.92	6.25

*Computation of a Newman-Kuels test revealed significant differences between 8 of the 10 treatment means. The only non significant differences occurred between Treatments 2 and 3, and between Treatments 4 and 5.

Table 10

Analysis of Variance:
Comparison of Open-Ended and Alternative-Choice Conditions

Source	SS	df	MS	F	P	eta^2
Treatment	32.58	1	32.58	7.00	<.01	.04
Error	902.52	194	4.65			
TOTAL	935.10	195				